



# RF Products Catalog

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# Designing and Testing RF Devices That Connect the World

Wireless technology connects everyone and everything, everywhere. New innovations continue to emerge — from smart cities to smart wearables — generating billions of new connections and exabytes of new data. Our world is becoming more connected, and that makes meeting consumer expectations more challenging. Technology is evolving across multiple dimensions at once.

- Faster data communication speeds require higher precision signals, broader frequency ranges, wider bandwidths, and higher data rates.
- More devices mean more semiconductor integration, more features, more ports, and longer-lasting battery life.
- Newly connected innovations — from billions of Internet of Things (IoT) devices to connected cars and connected power grids.

These connections require less power, more speed and accuracy of each signal and data communication. Keysight will be there with the test solutions you need to deliver breakthrough technologies faster.

**Keysight is helping innovators to connect the world, anywhere, anytime with any information**

— voice, data, video, and whatever they can imagine next. We are leading the innovation processes in the industries that drive this revolution — automotive, aerospace and defense, energy, wireless communications, and IoT.



# The RF Toolbox: Testing Today's Communications Systems

Today's wireless communication systems incorporate complex digitally modulated waveforms to maximize data and minimize bandwidth. The systems and underlying components which transmit and receive signals have become more complex, resulting in more complex test requirements.

A basic RF toolbox includes the following:

- Signal generators provide a variety of digital modulation formats to test modern wireless communication systems.
- Spectrum analyzers search and detect low-level signals across wide frequency spans in desired bandwidths.
- Network analyzers provide enough dynamic range and accuracy to characterize the filters and amplifiers needed to support these systems.
- Portable, durable handheld analyzers bring lab-quality test instrumentation to the field.

## Key instrument features to fit your needs now and in the future



**Sensitivity** – the minimum received power required for minimum errors



**Transmitter output power** – sets the range and antenna size to meet your requirements



**Adjacent channel selectivity** – the ability of a receiver to demodulate within the desired band while an interference signal exists in an adjacent band



**Operating frequency** – the transmit / receive frequency ranges or bands to meet your requirements



**Environment/interference** – factors such as humidity, obstacles in the transmit / receive path, and delays that can impact performance



**Noise** – sets the low signal performance from random sources, interference, and jamming signals



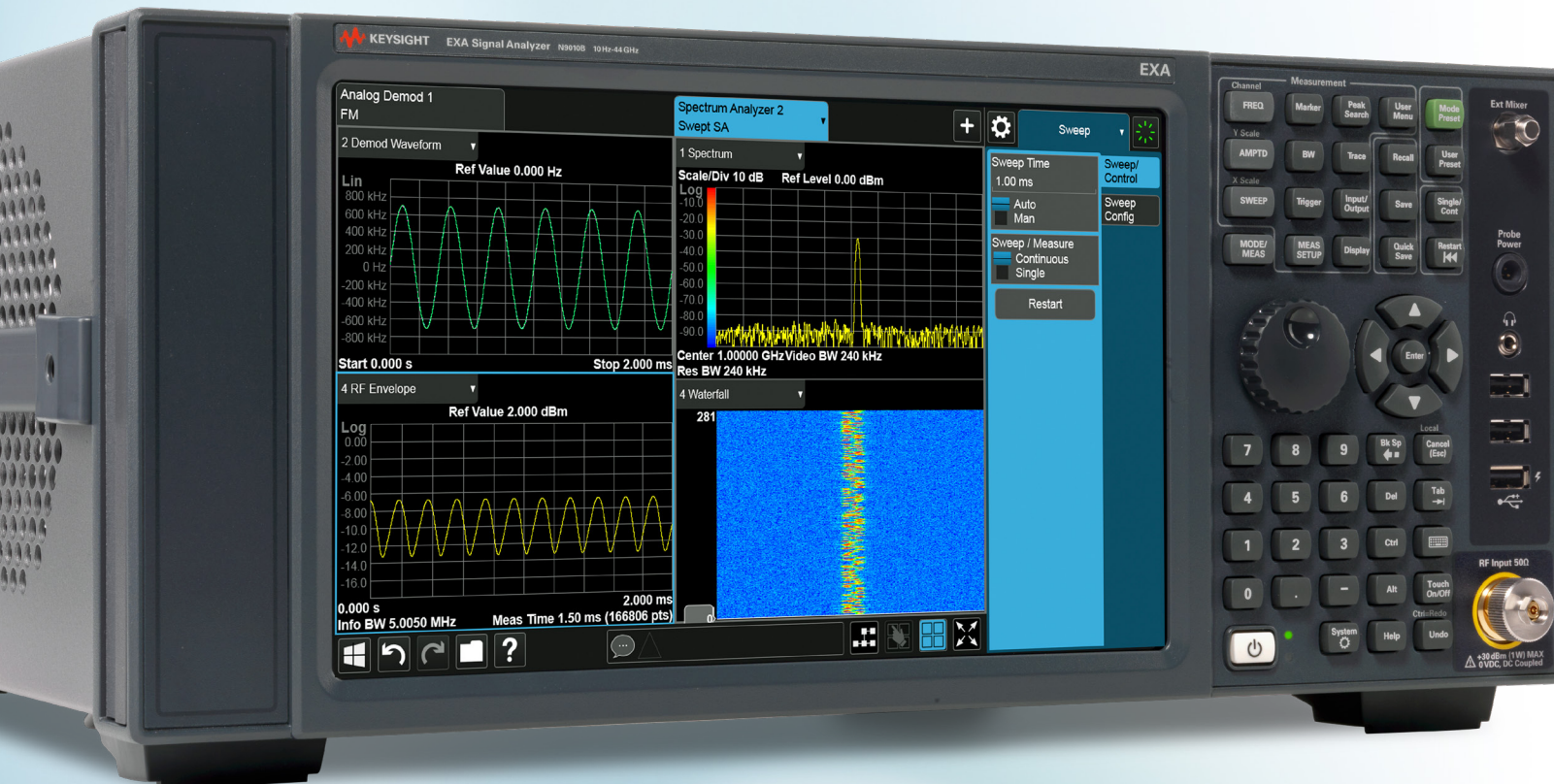
**Dynamic range** – the difference between the highest level and lowest level signal detectable



## MASTER RF TEST TECHNIQUES WITH FREE KEYSIGHT UNIVERSITY COURSES

Keysight University courses will advance your knowledge of precision RF measurement approaches, the latest industry standards, compliance, power, and more. You can learn basic to advanced techniques, tips, and tricks that lead to more accurate measurements and more insightful signal interpretation.

Whether you are just starting out or have decades of electronics design experience, Keysight University has a curriculum for you.



# Signal Generators

## PRODUCE THE SIGNALS YOU NEED WITH OUR WIDE SELECTION OF SIGNAL GENERATORS

- Take your devices to the limit with purity and precision fine-tuned for the highest performance.
- Achieve faster throughput and higher uptime with cost-effective essential signal generation.
- Reduce the time you spend on signal creation with Keysight's PathWave signal generation software.
- Lower your cost of ownership with a three-year calibration cycle and the most comprehensive solutions for self-maintenance.



M9484C Microwave Vector Signal Generator

# Signal Generators

Product Family	Type	Model number	Maximum frequency	Phase noise at 1 GHz, 20 kHz offset	Max output power at 20 GHz	Frequency switching	Max RF bandwidth (internal / external)
VXG	Vector	M9384B	44 GHz	-140 dBc / Hz	+21 dBm	90 ms	2 GHz / 4 GHz
	Vector	M9484C	54 GHz (110 GHz <sup>1</sup> )	-148 dBc / Hz	+22 dBm	3.0 ms	2.5 GHz (5 GHz <sup>2</sup> )
VXG-m	Vector	M9383B	44 GHz	-140 dBc / Hz	+21 dBm	90 ms	2 GHz / 4 GHz
PSG	Vector	E8267D	44 GHz	-138 dBc / Hz	+22 dBm	9 ms	80 MHz / 4 GHz
	Analog	E8257D	70 GHz	-130 dBc / Hz	+26 dBm	9 ms	N/A
		E8663D	9 GHz	-130 dBc / Hz	+23 dBm <sup>4</sup>	9 ms	N/A
MXG	Vector	N5182B	6 GHz (7.2 GHz <sup>3</sup> )	-146 dBc / Hz	+26 dBm <sup>4</sup>	800 μs	160 MHz / 200 MHz
	Analog	N5183B	40 GHz	-139 dBc / Hz	+19 dBm	600 μs	N/A
		N5181B	6 GHz	-146 dBc / Hz	+24 dBm <sup>4</sup>	800 μs	N/A
EXG	Vector	N5172B	6 GHz (7.2 GHz <sup>3</sup> )	-122 dBc / Hz	+26 dBm <sup>4</sup>	800 μs	160 MHz / 200 MHz
	Analog	N5173B	40 GHz	-118 dBc / Hz	+19 dBm	600 μs	N/A
		N5171B	6 GHz	-122 dBc/Hz	+21 dBm **	800 μs	N/A
CXG	Vector	N5166B	6 GHz	-119 dBc/Hz	+18 dBm **	5 ms	120 MHz / 200 MHz

<sup>1</sup> Accompanies V3080A frequency extender <sup>2</sup> Accompanies channel bonding <sup>3</sup> Frequency extension to 7.2 GHz available for the EXG and MXG <sup>4</sup> Max output power measured at 1 GHz for instruments that do not support up to 20 GHz

## SIMPLIFY SIGNAL CREATION WITH PATHWAVE SOFTWARE

PathWave signal creation software helps you generate application specific test signals at baseband, RF, and microwave frequencies for use with Keysight signal generators. Reduce the time you spend on signal simulation by using performance optimized signals, validated by Keysight. You can modify these signals to meet your needs and quickly create custom reference signals for testing devices.



# X-Series Signal Analyzers

## DESIGN, TEST, AND DELIVER YOUR NEXT BREAKTHROUGH WITH OUR MOST ADVANCED SIGNAL ANALYZERS UP TO 110 GHz

- Choose from a range of models at different performance and price points — from low-cost essential measurements to advanced wide-open, real-time analysis.
- Analyze signals with our broad set of application software ranging from custom analysis to quick standards compliance verification.
- Evolve as technology changes with post-purchase upgrades such as frequency, bandwidth, real-time, and central processing unit (CPU)
- Drive consistent measurements across your organization with 100% code-compatibility from R&D to manufacturing.



# X-Series Signal Analyzers

Product	Maximum frequency	Bandwidth options	DANL @ 1 GHz	Phase noise at 1 GHz (10 kHz offset)	Maximum real-time bandwidth
N9042B UXA	110 GHz* Mixers to 1.1 THz	Standard: 10, 25, 40, 255 MHz Optional: 1, 1.5, 2, 4 GHz	-174 dBm	-135 dBc / Hz	N/A
N9041B UXA	110 GHz Mixers to 1.1 THz	Standard: 25 MHz Optional: 40, 255 MHz, 1 GHz	-174 dBm	-135 dBc / Hz	255 MHz
N9040B UXA	50 GHz Mixers to 1.1 THz	Standard: 25 MHz Optional: 40, 255, 510 MHz, 1 GHz	-174 dBm	-135 dBc / Hz	510 MHz
N9032B PXA	26.5 GHz Mixers to 1.1 THz	Standard: 10, 25, 40, 255 MHz Optional: 1, 1.5, 2 GHz	-174 dBm	-136 dBc/Hz	N/A
N9030B PXA	50 GHz Mixers to 1.1 THz	Standard: 25 MHz Optional: 40, 85, 160, 255, 510 MHz	-174 dBm	-136 dBc / Hz	510 MHz
N9021B MXA	50 GHz Mixers to 1.1 THz	Optional: 255, 510 MHz	-172 dBm	-130 dBc / Hz	510 MHz
N9020B MXA	50 GHz Mixers to 1.1 THz	Standard: 25 MHz Optional: 40, 85, 125, 160 MHz	-172 dBm	-114 dBc / Hz	160 MHz
N9010B EXA	44 GHz Mixers to 1.1 THz	Standard: 10 MHz Optional: 25, 40 MHz	-170 dBm	-109 dBc / Hz	N/A
N9000B CXA	26.5 GHz	Standard: 10 MHz Optional: 25 MHz	-163 dBm	-110 dBc / Hz	N/A

\* With V3050A Frequency Extender



## TRANSFORM YOUR SIGNAL ANALYZER WITH PATHWAVE X-SERIES MEASUREMENT APPLICATIONS

PathWave X-Series applications are proven, ready-to-use measurements for signal analysis. Capturing measurement expertise and delivering repeatable results, the applications let you see and understand the performance of your devices and designs.



N9042B UXA X-Series Signal Analyzer



# PXI Vector Transceivers

## ADVANCING WIRELESS MANUFACTURING TEST

Increase manufacturing throughput with our fast PXIe vector transceivers - a signal generator and signal analyzer in one PXIe module. The PXIe vector transceiver is perfect for manufacturing test of wireless devices, RF power amplifiers, and front-end modules:

- Open source test libraries and reference solutions reduce development time.
- PathWave X-series measurement applications and signal generation software ensure specific wireless standards conformance.



M9410A VXT  
PXI Vector Transceiver

# PXI Vector Transceivers

Product number	PXI slots	Frequency range	Maximum RF bandwidth	SSB phase noise at 1 GHz (10 kHz offset)	Maximum output power (at 1 GHz)	DANL (at 1 GHz)
M9421A	4	60 MHz to 6 GHz	160 MHz	-111 dBc / Hz	+20 dBm	-160 dBm
M9410A	2	380 MHz to 6 GHz	1.2 GHz	-129 dBc / Hz	+20 dBm	-163 dBm
M9411A	3	1 MHz to 6 GHz	1.2 GHz	-129 dBc / Hz	+20 dBm	-163 dBm
M9415A	3	380 MHz to 12 GHz	1.2 GHz	-130 dBc / Hz	+20 dBm	-167 dBm

# Network Analyzers

## OVER 70% OF ENGINEERING TEAMS AROUND THE WORLD SELECT KEYSIGHT NETWORK ANALYZERS

- Attain unrivaled excellence with the PNA series benchtop network analyzers — up to 120 GHz, extensible to 1.5 THz.
- Drive down the cost of test with ENA network analyzers — up to 53 GHz.
- Accelerate the test of multiport devices with the PXI VNA — up to 53 GHz, 50-ports.
- Get a compact USB form with zero compromise in functionality — up to 53 GHz.
- Perform complete characterization including EVM and ACP with Vector Component Analyzers — up to 67 GHz.





# Network Analyzers

Form factor	Product	Maximum frequency	Dynamic range *	Output power *	Source harmonics (typ.)	Number of ports
Benchtop	PNA mm-wave	110,120 GHz	>115 dB	4 dBm	-40 dBc	2, 4
	PNA-X	67 GHz	130 dB	10 dBm	-60 dBc	2, 4
	PNA	67 GHz	130 dB	11dBm	-60 dBc	2, 4
	E5080B ENA	53 GHz	140 dB	10 dBm	-25 dBc	2, 4
	E5063A ENA	18 GHz	117 dB	0 dBm	N/A	2
	E5061B ENA	3 GHz	120 dB	10 dBm	N/A	2
PXI	M980xA PXI	53 GHz	140 dB	10 dBm	-25 dBc	2, 4, 6 (per module)
	M937xA PXI	26.5 GHz	115 dB	7 dBm	-14 dBc	2 (per module)
Streamline	P50xxB Thunderbolt	53 GHz	140 dB	10 dBm	-25 dBc	2, 4, 6
	P50xxA USB	53 GHz	140 dB	10 dBm	-25 dBc	2, 4, 6
	P93xxB Thunderbolt	26.5 GHz	115 dB	8 dBm	-25 dBc	2, 4
	P937xA USB	26.5 GHz	115 dB	7 dBm	-14 dBc	2

\* Dynamic range and output power specifications apply to whole family. Differences can be found at specific frequencies. Please consult the instrument datasheet for more information.

## NETWORK ANALYSIS MEASUREMENT EXPERTISE

Investigate, characterize, and troubleshoot your designs using our wide range of network analyzer measurement applications.

- Amplifier, filter, mixer, material, high-speed serial interconnect analysis capabilities, and more
- Time domain, gain compression, pulse, noise figure, permittivity, permeability, TDR/TDT, and more
- Modulated signal measurements such as EVM and ACP



E5080B ENA Vector Network Analyzer

# FieldFox Handheld RF, Microwave, and mmWave Analyzers

## CARRY PRECISION WITH YOU

- Make 5G test a reality with over-the-air analysis, phased array measurements, and bandwidth up to 120 MHz.
- Capture the smallest interfering signals with a wide-band, real-time analysis.
- Get precision results up to 54 GHz that are comparable to benchtop devices.
- Withstand your harshest working environment with an instrument that meets military specifications (MIL-SPEC).
- Use an all-in-one combination analyzer that performs cable and antenna testing, vector network analysis, spectrum analysis, signal analysis, and more.

Products	Base model	Maximum frequency	Maximum real-time analysis bandwidth	DANL @ 1 GHz	VNA system dynamic range	Overall spectrum analyzer amplitude accuracy	Output power
N9913A	Combo analyzer	4 GHz	10 MHz	-155 dBm	100 dB	±0.35 dB	Up to 1 dBm
N9913B	Combo analyzer	4 GHz	120 MHz	-163 dBm	>114 dB	±0.2 dB	Up to 9 dBm
N9935B	Spectrum analyzer	9 GHz	120 MHz	-163 dBm	—	±0.2 dB	Up to 9 dBm
N9928A	Vector network analyzer	26.5 GHz	—	—	100 dB	—	Up to 1 dBm
N9960A	Spectrum analyzer	32 GHz	10 MHz	-159 dBm	—	±0.3 dB	Up to 4 dBm
N9952B	Combo analyzer	50 GHz	120 MHz	-163 dBm	>105 dB	±0.2 dB	Up to 7 dBm
N9962B	Signal analyzer	50 GHz	120 MHz	-163 dBm	—	±0.2 dB	Up to 6 dBm



## INVESTIGATE INTERFERENCE ISSUES IN THE FIELD WITH RTSA

Interference is everywhere — and traditional analysis is not reliable. This white paper discusses interference sources, the flaws of traditional analysis, and how real-time spectrum analysis (RTSA) improves interference detection.



N9913B FieldFox  
Handheld Microwave Analyzer



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